# Trial Furnace

**2005-06-05**

I used a refractory mix similar to that on Lionel Oliver's site:

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4 Silica
4 Fireclay
3 Vermiculite
3 Cement
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The silica, fireclay and vermiculite were sourced from Walker Ceramics, and the cement from Bunnings.

It was dampened to a crumbly dough and a number of different shapes were cast and rammed including pipes, bricks, plugs, rods, etc. Most importantly a "M&Ms bucket" was lined in a geometry similar to a conventional drum or bucket furnace, except without the drain hole at the bottom. A matching plinth and a somewhat undersized lid was also made with the remainder of the refractory batch.

After two days cure time the molds where stripped and the rough edges cleaned up with a knife where required. Unfortunately I scratched up and cracked the furnace body removing it from the plastic bucket and extracting the plastic jar that formed the hollow space. About one third of the circumference of the side wall came out, but as nothing much could be done about it I decided to go ahead put it back together and try it out anyway as this was just a throw-away furnace to teach me the basics.

The still damp material was put into the kitchen oven, heated slowly to 90 °C and held there for 2 hours. At which point it looked bony and white but wasn't at constant mass. The temperature was raised to 350 °C and held for another three hours to expel any remaining unbound water.

Once cool the tuyere in furnace body was drilled out using a 38 mm holesaw so it would accommodate the 20 mm burner rather than building a smaller dedicated unit more suited to this furnace. The flue hole in the top lid was probably undersized for such a relatively large burner, but for a proof of concept run it appeared sufficient.

The furnace was then put to the test. Fired gently at first it came up to red heat without incident in only a few minutes. It was held at red heat for 20 minutes to season it and then the burner was cranked up to 150 kPa and yellow heat was easily achieved, completely vitrifying the lining and colouring the flames with calcium and sodium ion emissions. I did manage to crack the lid by rough handling with a pair or pliers while it was hot, my fault for not building in a handle. Reminds me - build some tongs...

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As a quick experiment a galvanized pipe cap was used as a crucible to melt a small quantity of Aluminium. Pretty blue-green flames sprayed around the poorly sealing lid and out the flue, terminating into a jet of white zinc fumes which I carefully avoided inhaling. Once the Zinc had burnt off completely it was observed that the crucible was glowing bright cherry red and inside a puddle of Aluminium had formed.

Upon cooling the plinth was fused to the crucible (I forgot the paper or graphite). The pipe cap itself had a thick layer of black scale that could be chipped off fairly easily and allowed separation from the now glassy plinth. The Iron had diffused into the glass at the contact point darkening it.

I couldn't quite melt Iron in the furnace, but I did manage to get it up to forging temperature, I am fairly confident this simple lash-up could hit cone 10 without too much of a problem. Copper and Bronze should be a snack, Aluminium is very easy. Unfortunately my budget pyrometric thermometer is rated to only 500

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°C (but operates to about 700 °C) so I'll have to investigate alternative methods of measuring the temperatures involved.

After several cycles the furnace is looking the worse for wear, but it is still quite usable, some shrinkage and crumbling around the original pre-firing breakage has made it leak a little, but it still heats quickly and melts Aluminium in less than 5 minutes from cold. Of course it can't melt much because its only about 3" ID, but it is a good experimental tool or a small gas forge.

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The experience taught me to make my form work easier to remove to avoid mechanical damage to the refractory during stripping. The refractory itself turns into green glass a little too easily for my taste and is still fairly conductive and dense. I suspect a mixture richer in Silica and Vermiculite with a minimum of Portland Cement would be superior. I'm not completely sold on Fireclay yet. Perhaps waterglass binding is worth a try, I believe Sodium Silicate is better cooling down than Calcium Silicate.

2 comments.

## Attachments

| title | type | size |
|---|---|---|
| close up on broken wall | image/jpeg | 40.857 kbytes |
| short video of the furnace burning | video/x-msvideo | 1.062 Mbytes |

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